PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: LEONID IZRAILEVICH KROPP, DANIIL LVOVICH ITMAN, NIKOLAI VASILIEVICH KUZNETSOV, EMMANUIL MOISEEVICH LIVSHITS and ALEXANDR ISAKOVICH LAKHMANLOS

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COMPLETE SPECIFICATION

A Device for Vibrational Cleaning of Tubular Heating Surfaces in Heat-exchange Plants from External Contamination Mainly of Slag and Ash

We, VSESOJUZNY TEPLOTEKHNICHESKY INSTITUT IM F, E, DZERZHINSKOGO, of Leninskaya sloboda, 23, Moscow, Union of Soviet Socialist Republics, A corporation organised under the Laws of the Union of Soviet Socialist Republics, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to devices for cleaning tubular heating surfaces in heat exchange plants from external contamination, and more particularly to devices for the vibrational cleaning of tubular heating surfaces from external contamination mainly of slag and ash.

Known in the art are devices for the vibrational cleaning of tubular heating surfaces in boilers from slag and ash contaminations, in which an oscillator or vibrator is connected to a tubular heating surfaces or pipes by means of rigid bars, and imparts to the pipes vibratory movements that are transversely directed relative to the longitudinal axes of the pipes.

The bars, being of a relatively great length, are connected to the pipes at places which are most remote from collectors. The vibrations imparted to the pipes are usually of a constant frequency.

The main disadvantages to the known devices of the above indicated type are as follows: a non-uniform distribution of the vibrations over the length of pipes being cleaned and along the width of stacks of pipes due to the concentration of vibration at certain points on separate pipes and to defects in fastening the pipes to the metal framework; the limited possibility of using frequency vibrations because of their more abrupt damping in long bars connecting the vibrator to the pipes; the complications involved in cleaning pipes disposed in a zone of high temperatures, on account of the necessity of specially cooling the bars connecting the vibrator to the pipes, or in partially withdrawing the pipes to be cleaned out of the heating zone; a non-uniform cleaning of pipes because of the formation of standing waves in a fixed arrangement of sub-assemblies and peaks with a constant frequency of vibrations being generated.

An object of the present invention is to eliminate the above disadvantages.

The principal object of the present invention is to provide a device for vibratory cleaning pipes in zones of high temperatures without the use of special cooling systems, which would ensure a high degree of cleaning with uniform distribution of the vibrations over the whole length of the pipes being cleaned and the width of tubular stacks of pipes.

The invention consists in a device for vibrational cleaning of external contamination from heat-exchange surfaces heated by gases at elevated temperatures in heat-exchange plants, mainly boiler units, wherein a vibrator is connected by suspension means to said surfaces, said suspension means being in the high-temperature working zone and said suspension means simultaneously serving as elements transmitting the vibratory force.

It is desirable to connect the pipes to the framework of the heat-exchange plant by

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means of dampers, preferably of spring type, while the vibrator is connected by a system of rods to the pipes.

If there are a plurality of collectors, arranged at small distances one from another, it is desirable to connect the pipes to the frame of the heat-exchange plant by means of dampers, preferably of spring type, while the vibrator is connected by means of a system of rods to collectors, to which are connected the pipes.

It is desirable to provide in the vibrator a device for the gradual or stepwise variation of the frequency of vibrations in a range of working frequencies, and to produce a standing wave running along the pipes.

In an embodiment of the device of the invention, it is desirable to fix the vibrator to the pipes in such a manner that the rigidity of the fastening could be varied in the process of cleaning so as to produce a standing wave running along the pipes.

A plurality of exemplary embodiments of the present invention is represented in the appended drawings, in which:

Fig. 1 is a side elevation view of the device for cleaning the pipes of a boiler with collectors disposed above;

Fig. 2 is a cross-section view of the device of Fig. 1 taken along lines I—I;

Fig. 3 is a side elevation view of the device for cleaning bent stacks of pipes of various kinds;

Fig. 4 is a cross-sectional view of the device of Fig. 3 taken along lines II—II.

The device (Figs. 1 and 2) comprises a vibrator I rigidly connected to collectors 2 by means of suspension bars 3 that are rigidly connected to a vibratory plate 4. The vibratory plate 4 is mounted on beams 5 of the boiler framework with the aid of spring dampers 6 that are simultaneously employed as suspension means for a stack of pipes 7 and collectors 2.

Diaphrams 9 are used to seal the places where pipes pass through the insulation 8 of the boiler.

The vibrator 1 is mounted in such a manner that the vibrations generated by it are transmitted to the pipes along their axes.

Produced in each pipe are both longitudinal and transversal vibrations, the combined action of which is likely to ensure the efficient seperation of slag and ash deposits from their surface.

The mounting of the pipes to be cleaned on spring dampers precludes the possibility of transmitting vibrations to the framework of the heat-exchange plant, and contributes to a more uniform distribution of vibrations all over the surface to be cleaned.

Any electromechanical, electrical, pneumatic, or other type vibrator with a relatively high vibration frequency may be employed as the vibrator.

The values of the frequency and the amplitude of the vibrations are set according to the value of acceleration, which must be imparted to the pipes to be cleaned, and consequently to its deposits of ash or slag.

The system of control of the vibrator operation is provided with devices to set up a running wave, which is responsible for the absence of stationary zones, wherefrom the deposits cannot usually be removed with sufficient efficiency.

The wave running along the pipes is produced by varying gradually, or in a stepwise manner, the frequency of the vibrations within a range of working frequencies, which is achieved by varying the frequency of current supplied in the electrical and electromagnetical vibrators, or by varying the pressure of compressed air in pneumatic vibrators.

The running wave may be also produced by varying the rigidity of fastening the vibrator to the pipes. This is achieved by using rods of the telescopical type, the length of which may vary during the process of cleaning, or by partially fastening the vibrator with elastic elements with a controllable rigidity.

Figs. 3 and 4 represent an embodiment of the device applicable to various kinds of bent stacks of pipes 10, suspended at 11 to a system of beams 12 which, in turn are connected by bars 3 to the vibratory plate 4. The plate 4 bears on spring dampers 6 mounted on beams 5. The dampers 6 simultaneously serve as suspensions for the pipes 10. The suspensions 11 are provided with insulation 13 where they pass through the brick lining.

Various modifications may be made within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A device for vibrational cleaning of external contamination from heat-exchange surfaces heated by gases at elevated temperatures in heat-exchange plants, mainly boiler units, wherein a vibrator is connected by suspension means to said surfaces, said suspension means being in the high-temperature working zone and said suspension means simultaneously serving as elements transmitting the vibratory force.

2. A device as claimed in claim 1 wherein the heat-exchange surfaces are connected to one portion of a collector and the vibrator is mounted to another portion of the collector.

3. A device as claimed in claim 1 wherein the heat-exchange surfaces are connected to the framework of the heat-exchange plant by dampers, and the vibrator is connected to the said surfaces by at least one bar.

4. A device as claimed in either claim 1 or 2 wherein the heat-exchange surfaces are connected to the framework of the heat-exchange plant by dampers and the vibrator is connected by means of at least one bar to a collector

which in turn is connected to the tubular heating surfaces.

5. A device as claimed in either claim 3 or 4 wherein the dampers are of the spring type.

6. A device as claimed in any one of the preceding claims wherein the vibrator is provided with means for gradual or stepwise variation of the vibration frequency within a range of working frequencies to produce a wave running along the said surfaces.

7. A device as claimed in any one of the preceding claims wherein the rigidity of the connecting means between the vibrator and the tubular heating surfaces may be varied during the process of cleaning.

8. A device for vibrational cleaning as substantially described herein and illustrated in Figs. 1 & 2 of the accompanying drawings.

9. A device for vibrational cleaning as substantially described herein and illustrated in Figs. 3 & 4 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicant(s).

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

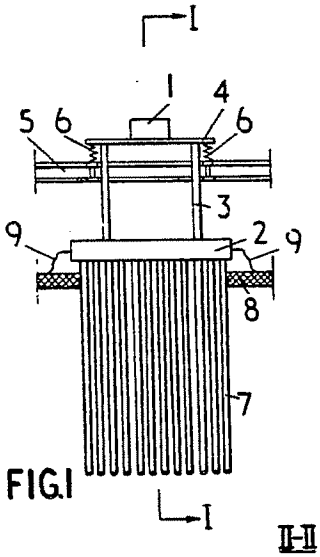

FIG.1

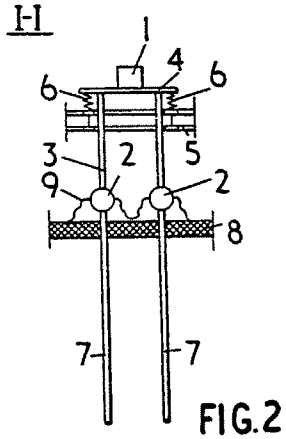

FIG.2

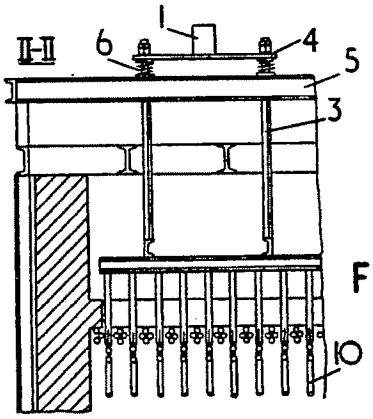

FIG.4

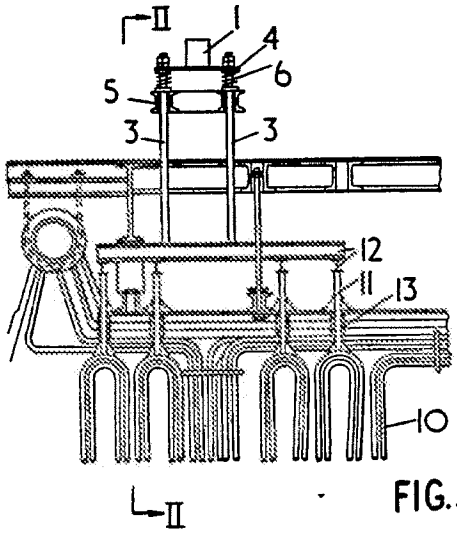

FIG.3

PATENT SPECIFICATION

DRAWINGS ATTACHED

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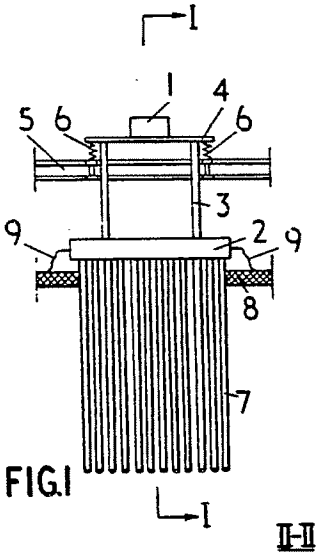

FIG.1

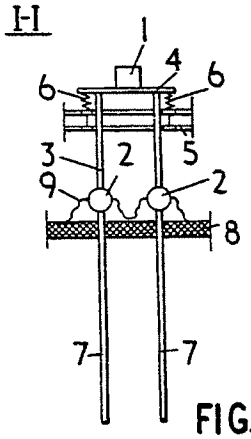

FIG.2

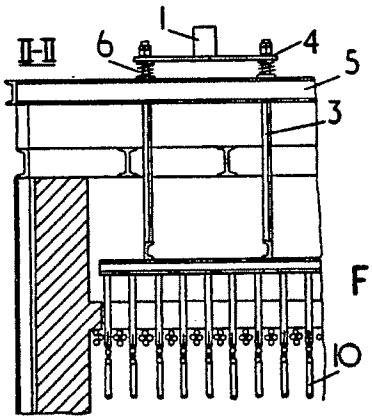

FIG.4

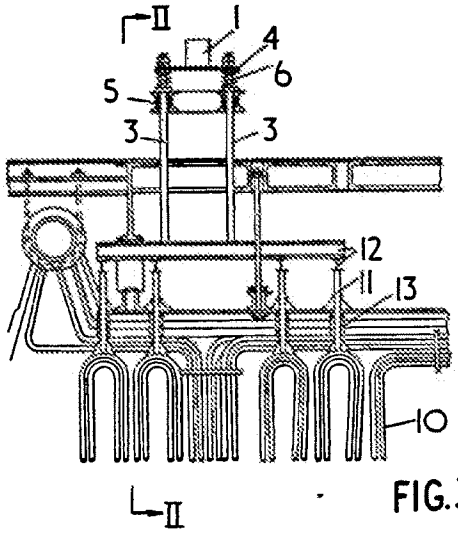

FIG.3